IEA Wind Task 36 on Wind Power Forecasting

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Abstract

This poster gives an overview of the IEA Wind Task for Wind Power Forecasting. The Operating Agent is Gregor Giebel of DTU, Co-Operating Agent is Joel Cline of the US Department of Energy. Collaboration in the task is solicited from everyone interested in the forecasting business. We will collaborate with IEA Task 31 Wakebench, which developed the Windbench benchmarking platform, which this task will use for forecasting benchmarks. The task will run for three years, 2016-2018.

Main deliverables are an up-to-date list of current projects and main project results, including datasets which can be used by researchers around the world to improve their own models, an IEA Recommended Practice on performance evaluation of probabilistic forecasts, a position paper regarding the use of probabilistic forecasts, and one or more benchmark studies implemented on the Windbench platform hosted at CENER. Additionally, spreading of relevant information in both the forecasters and the users community is paramount.

The poster also shows the work done in the first 9 months of the Task, e.g. the collection of available datasets and the learnings from a public workshop on 9 June in Barcelona on Experiences with the Use of Forecasts and Gaps in Research.

Participation is open for all institutions in member states of the IEA Annex on Wind Power, see ieawind.org for the up-to-date list.

Activities

NWP Improvements

This WP will bring together global leaders in NWP models as applied to the wind industry to exchange information and recommendations regarding most promising areas to improve both the physics of these models and data assimilation methods, and the influence of various data types, such as data from drones, masts, lidars and turbines in data-sparse areas, e.g. offshore for wind energy forecasting. The emphasis will be on improvements of the wind-related forecast performance of these models especially in typical rotor heights. There, the effects of changing stability, complex terrain, the influence of the surface and phenomena such as low-level jets still are only poorly modeled. Forecasting time horizons of 0-3 hours, 3-12 hours, day ahead, 2 weeks ahead, and seasonal are the relevant time scales for the power system, and will be the focus of separate investigations. This can include artificial intelligence techniques or Rapid Update Cycles.

Task 1.1: Compile list of available data sets, especially from tall towers.

Task 1.2: Creation of annual reports documenting and announcing field measurement programs and availability of data.

Task 1.3: Verify and Validate the improvements through a common data set to test model results upon and discuss at IEA Task meetings

Benchmarks

This second work package will review the state-of-the-art for error and uncertainty quantification for wind and wind power forecasting models, with a special emphasis on the underlying NWP forecasts. This activity will further engage both NWP and field measurement researchers to develop guidelines, best practices, and perhaps standards, for evaluating forecast uncertainties. For model evaluation, we would work together with Task 31 in their Model Evaluation Protocol (MEP) implemented in the WindBench platform [10]. This would include trying to use some of their collected datasets while also opening a call for additional datasets for benchmarking.

Task 2.1: Design of benchmark exercises: best practice

Task 2.2: Standard evaluation protocol for both deterministic and probabilistic forecasts: review of existing, best practice, and critical assessment of new proposals

Task 2.3: Uncovering uncertainty origins and development through the whole modelling chain. Parallels with the Windbench platform.

Task 2.4: Set-up and dissemination of benchmark test cases and data sets

Advanced Usage

The third WP will survey the current state of use of forecast uncertainties by the power systems sector, which will be documented in a report. It will then engage both actors of the wind industry and the research communities to identify how current and emerging capabilities to determine uncertainties can be used to address the variety of decision-support needs of the industry. Where useful, simple indicators of forecast quality will be developed. This WP will also provide outreach to users of forecasts via webinars or other means to enhance their knowledge and ability to use all available information for operations.

Task 3.1: State of the art of use of forecasts uncertainties in the business practices of actors in the power systems

Task 3.2: State of the art and knowledge sharing from demonstration/pilot projects that deal with the use of forecasts in decision making.

Task 3.3: Multi annual time series that simulate wind power forecast errors with hourly resolution. State of the art, benchmarking, recommended methodology.

Task 3.4: How to measure/quantify the value from the use of probabilistic forecasts

Task 3.5: Communication of wind and wind power forecasts to end-users.

Task 3.6: Set up data sets for benchmarking on the value from the use of forecasts, e.g., for trading.

First Results

List of high masts

A list with masts useful for validation of the forecasts is underway, measuring at least 100m.

The list currently contains more than a dozen masts on- and offshore.

Mast at Risø.

Workshop Future Issues

In July, the group held a public workshop in Barcelona on Experiences with Forecasts and Gaps in Research. The slides are available from the website.

The **most important gaps** were identified as:

More frequent, and higher time and spatial resolution data. Short-term ensembles.

Data assimilation of wind power data, and improved NWP model physics, including icing.

Interaction between wind farms.

Ramps, and seasonal forecasting.

Optimal use of probabilistics, and reliable quantiles.

Advanced Usage Questionnaire

We currently conduct a mapping of the use of probabilistic forecasts in the industry. Please help us filling it in (scan the QR code):

Preliminary results:

Knowledge about how to make use of uncertainty forecasts is lacking:

98% use multiple forecasts

60% know provider and products of uncertainty forecasts

< 10% make use of uncertainty forecasts

Less than 10% of all organisations employ meteorologists or engineers with an atmospheric science education

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